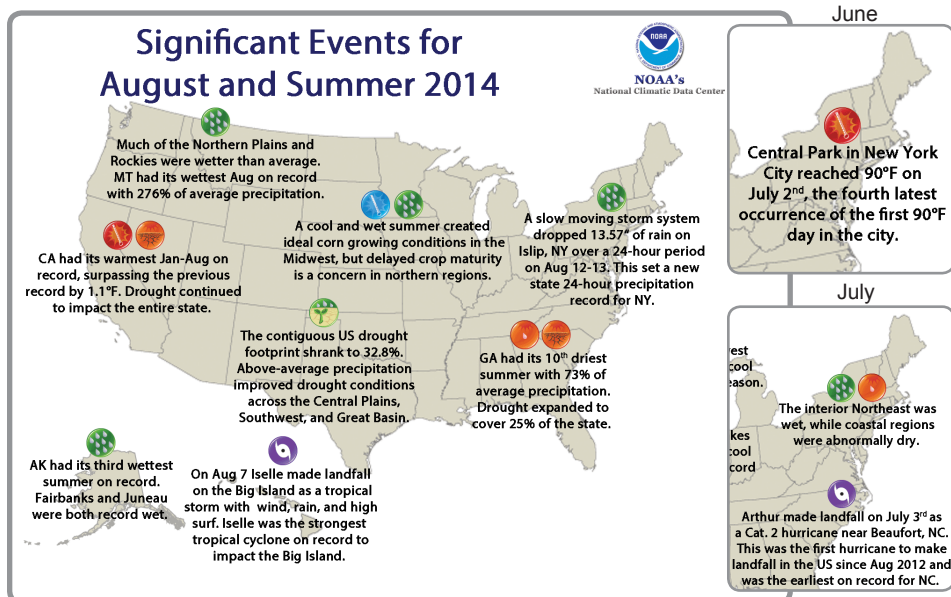


National - Significant Events for June–August 2014



Highlights for the East

Severe storms struck the region throughout summer. Forty-eight tornadoes touched down, with the majority occurring in July. A tornado in Madison County on July 8 was the second deadliest tornado in New York. A tornado in Suffolk County, MA, on July 28 was the first tornado to strike the county since records began. Also, straight line winds of up to 100 mph caused extensive damage. Flash flooding accompanied the storms, as did large hail.

In early July, Hurricane Arthur's storm surge and heavy rain caused flooding in coastal North Carolina and southeastern Massachusetts. Arthur was the earliest hurricane to make landfall in North Carolina since records began in 1851.

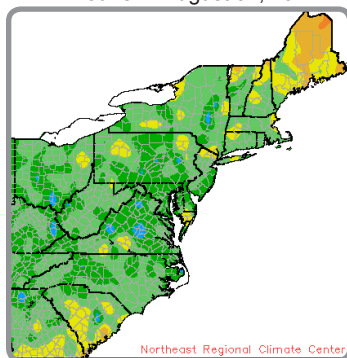
On August 12 and 13 extreme rainfall shattered records and caused significant flash flooding. Numerous roads, including major highways, were submerged under feet of water, leaving cars stranded and leading to dozens of water rescues. Also, two long-term parking lots at Baltimore–Washington International Airport were partially flooded. *For details on the rainfall, see the Regional Climate Overview section below.*

During summer, the contiguous United States had an average temperature of 71.1°F, 0.3°F above the 20th century average. This made it the coolest summer since 2009. Summer precipitation in the contiguous United States totaled 9.39 inches, 1.07 inches above average. This made it the ninth wettest summer on record and the wettest summer since 2004. The contiguous U.S. temperature-related energy demand was 8% below average during summer, based on NOAA's Residential Energy Demand Temperature Index.

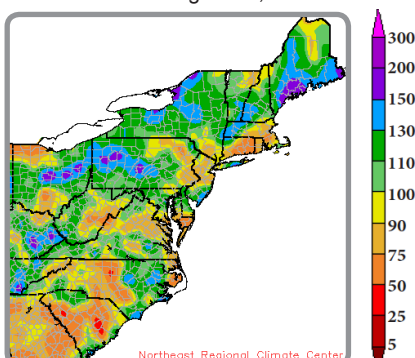
Regional - Climate Overview for June–August 2014

Temperature and Precipitation Anomalies

Departure from Normal Temperature (°F)
June 1–August 31, 2014



Percent of Normal Precipitation (%)
June 1–August 31, 2014



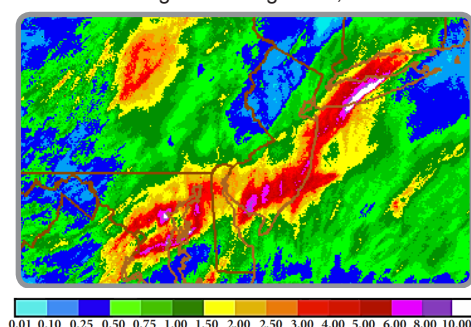
The average summer temperature for the Eastern Region was 70.2°F, 0.6°F cooler than normal. Fourteen of the sixteen states saw below-normal temperatures. Maine, however, had its 15th warmest summer on record. June was warmer than normal for all states, with the region 1.0°F above normal. Ten states were cooler than normal during July, with the region 1.2°F below normal. Ohio and West Virginia had their 3rd and 16th coolest July on record, respectively, while Rhode Island had its 19th warmest July. The region ended August at 1.5°F below normal. Fifteen states were cooler than normal, with Virginia and North Carolina ranking the month among their top 20 coolest.

The Eastern Region picked up 105% of normal rainfall during summer. Of the nine wet states, three ranked the season among their top 20 wettest. South Carolina had its 20th driest summer on record. Ten states were drier than normal in June, but the region ended the month at 100% of normal. Delaware had its 19th driest June on record, while Ohio had its 19th wettest. In July, the region saw 107% of normal rainfall. Ten states were wetter than normal, with five ranking this July among their top 20 wettest. The region received 101% of normal rainfall in August, with nine states drier than normal.

Normals based on 1981–2010

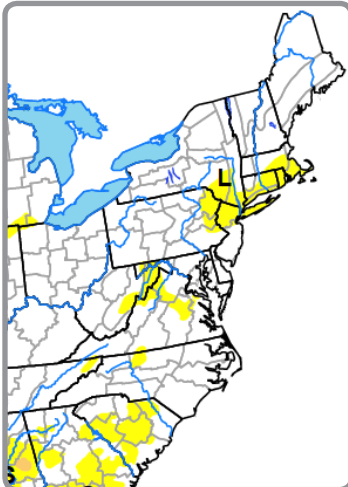
August Extreme Rainfall

24-Hour Total Precipitation (in.)
Ending 8 a.m. August 13, 2014



Islip, NY, saw 13.57 inches of rain on August 12–13. The site set a New York State 24-hour precipitation record, had its wettest August on record, and tied its all-time wettest month on record. This was a 200-year storm event, meaning rainfall of that magnitude is only expected to occur once in a 200-year period. The preliminary NOAA Atlas-14 amounts were extremely close to the Northeast Regional Climate Center [Extreme Precipitation Analysis](#) for the 10–100 year event for durations of 6 and 24 hours. Baltimore, MD, and Portland, ME, which both saw over 6 inches of rain on the 12th or 13th, had their highest amount of precipitation for any calendar day that was non-tropical based. In addition, Portland set hourly and consecutive two-hour rainfall records.

Regional - Impacts for June–August 2014



Intensity:
 D0 Abnormally Dry
 D1 Drought - Moderate
 D2 Drought - Severe
 D3 Drought - Extreme
 D4 Drought - Exceptional

Drought Impact Types:
 ~ Delineates dominant impacts
 S = Short-Term, typically <6 months
 (e.g. agriculture, grasslands)
 L = Long-Term, typically >6 months
 (e.g. hydrology, ecology)

The U.S. Drought Monitor released on September 16, 2014. Parts of southern New England, the Carolinas, and Virginia experienced abnormally dry conditions through much of summer. Other areas received extreme rainfall.

Sea Level Rise

Rising sea levels have increased "nuisance flooding" by up to 925% since the 1960s, according to a recent NOAA report. Nuisance flooding causes "public inconveniences such as road closures, overwhelmed storm drains, and compromised infrastructure." Of the top ten cities that have seen an increase in this type of flooding, eight are located in the Eastern Region. Annapolis and Baltimore, both in Maryland, have seen the largest increase at 925% and 922%, respectively. Due to increased sea level, nuisance flooding no longer just occurs with coastal storms, but with high tides too. The report noted that other locations will begin to experience nuisance flooding as sea levels continue to rise, and if sea level rise accelerates, the impacts of the flooding would be intensified. Another report estimates that based on current projected sea level rise, average annual property losses due to coastal storms in the Northeast will likely increase by \$6–9 billion by 2100. Changes in hurricane activity due to climate change, such as increased intensity, would increase losses by \$11–17 billion. Sea level rise also affects coastal ecosystems through erosion, inundation of wetlands, and changes in water salinity. Due to its low elevation and tidal range, the Atlantic coast is particularly susceptible to wetland losses.

Precipitation Variability

Precipitation was highly variable in the Eastern Region this summer. Coastal Maine received around 145% of its normal summer rainfall, while just to the south, coastal Massachusetts experienced abnormally dry conditions. In Virginia and the Carolinas, rain totals ranged from less than 25% of normal in some areas to more than 200% of normal in other areas in July and August. Locally heavy rainfall affected sites such as Islip, NY; Raleigh, NC; and Portland, ME. Consistent with a changing climate, the frequency and intensity of heavy precipitation events will continue to increase, but so will the annual number of consecutive dry days. That's because higher temperatures lead to greater evaporation (leading to drier conditions), but a warmer atmosphere can contain more moisture (leading to heavier downpours).

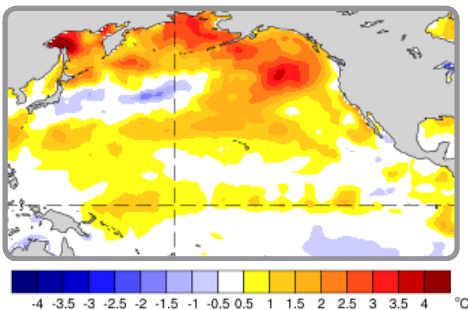
Agriculture

Last winter's cold temperatures damaged up to 90% of buds of some grape varieties in parts of the region. Due to low grape supply and high demand, New York is allowing wineries to use out-of-state grapes for the first time since 2005. The harsh winter also wiped out Ohio's peach crop. The state had to import peaches from South Carolina, which rebounded from a slow start. In some areas, heavy rain caused soggy fields and crop diseases, but in other areas, crops were stressed by a lack of rain. While yields varied from farm to farm, corn and soybean harvests in Ohio were expected to surpass last year's record-setting numbers by 5–6%.

Regional - Outlook for Fall 2014

El Niño

Sea Surface Temperature Anomaly (°C)
 September 7–13, 2014



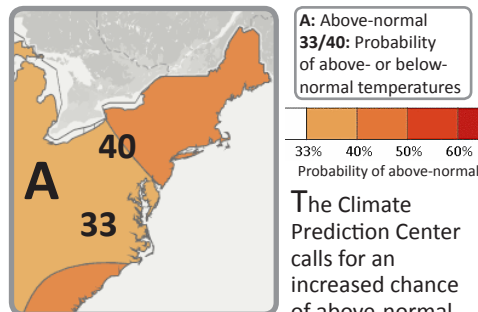
As of mid-September, El Niño conditions remained neutral in the equatorial Pacific. According to NOAA, "El Niño is favored to emerge during September–October, and to peak at weak strength during the late fall and early winter." There is a 60–65% chance of El Niño development during fall and winter. In addition to the potential warming of the tropical Pacific, much above normal sea surface temperatures in the North Pacific are expected to influence temperature and precipitation outlooks in fall and winter.

Updated 2014 Atlantic Hurricane Season

NOAA's updated Atlantic hurricane season outlook, released on August 7, calls for a 70% chance of a below-normal season. The initial outlook from May called for a 50% chance of a below-normal season. The updated outlook, which includes hurricanes Arthur and Bertha, predicts 7–12 named storms, 3–6 hurricanes, and 0–2 major hurricanes. In comparison, the May outlook predicted 8–13 named storms, 3–6 hurricanes, and 1–2 major hurricanes. The outlook changes are due to the development of atmospheric and oceanic conditions that inhibit storm formation, the expectation that unfavorable conditions will persist through the season, and the likely development of El Niño.

Temperature and Precipitation

Valid for October–December 2014



A: Above-normal
 33/40: Probability
 of above- or below-
 normal temperatures

33% 40% 50% 60%
 Probability of above-normal

The Climate Prediction Center calls for an increased chance of above-normal temperatures

for the entire Eastern Region for October–December. Much of the Northeast and parts of the Carolinas have the greatest chance for above-normal temperatures.

The precipitation outlook for October–December shows an increased chance of above-normal precipitation in the eastern Carolinas, with equal chances of above-, near-, or below-normal precipitation elsewhere.

Eastern Region Partners

National Oceanic and Atmospheric Administration

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 National Weather Service, Eastern Region
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 NOAA Fisheries Science Centers and Regional Offices, Atlantic
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 Climate Prediction Center
www.cpc.noaa.gov
 National Operational Hydrologic Remote Sensing Center
www.noahrs.noaa.gov

Northeast Regional Climate Center

www.nrcc.cornell.edu

Southeast Regional Climate Center

www.sercc.com

National Integrated Drought Information System

www.drought.gov

Carolinas Integrated Sciences and Assessments

www.cisa.sc.edu

Consortium on Climate Risk in the Urban Northeast

www.ccrun.org

Cooperative Institute for North Atlantic Research

www.cinar.org

Eastern Region State Climatologists

www.stateclimate.org